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DR. JAMES G. CARR, Chicago, *Editor*DR. GILBERT H. MARQUARDT, Chicago, *Associate Editor*

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**CONDUCTION DISTURBANCES IN CORONARY ARTERY OCCLUSION  
WITH MYOCARDIAL INFARCTION**

In 375 cases of coronary artery occlusion observed by us intraventricular block, including bundle-branch block, and simple prolongation of the P-R interval were common, each occurring in 15 to 20 per cent of cases; partial and complete A-V block were encountered in 3 per cent.

**Pathology**

The anatomical basis of these conduction disturbances is usually infarction of the interventricular septum. Partial and complete A-V block are practically always associated with occlusion of the right coronary artery and posterior infarction, since the artery to the A-V node is a branch of this artery. On the other hand, bundle-branch block whether left or right, occurs irrespective of the artery occluded. The presence of profuse collateral circulation, particularly around the A-V node, prevents the more frequent occurrence of conduction defects, even in the presence of septal infarction, and accounts for their remission in some cases. Not infrequently A-V and intraventricular block are encountered in the same case, as a result of extension of the septal infarction to involve both the A-V tissues and bundle-branch system. Simple prolongation of the P-R interval, curiously, does not depend on a specific lesion in the conduction system. In addition to anoxemia, vagal influences are probably important in this disturbance, for it can be abolished by the injection of atropin, as in acute rheumatic fever. Atropin did not affect the other conduction disturbances. (A factor that probably plays a role in bundle-branch block is cardiac enlargement with which it was usually associated.)

**Clinical Course**

The sudden onset of any conduction disturbance, recognized electrocardiographically, may be the first or only sign of coronary occlusion. Complete A-V block alone gives rise to symptoms and thus lends itself to clinical diagnosis; the cardiac rate is usually less than 40 and a Stokes-Adams' syndrome is apt to be present, including syncope, coma or convulsions. We have been unable to detect bundle-branch block in our cases by physical signs. Gallop rhythm was present in 60 per cent of the cases but was merely an indication of the severity

of the heart failure. These conduction defects are associated with considerable heart failure.

Conduction defects usually appear at, or soon after, the onset of the occlusion. Prolongation of the P-R interval, however, not infrequently comes on later, and occasionally only after several weeks. The duration of the defects is variable. Partial A-V block as a rule remits within one or two weeks, rarely becoming permanent. Complete A-V block usually persists until death occurs. If the patient survives, it may become permanent or revert to normal sinus rhythm, usually through a stage of partial block. Bundle-branch and intraventricular block are permanent in the great majority of cases; rarely they are transient. It is obvious that many instances of chronic A-V block and bundle-branch block may have resulted originally from coronary occlusion with infarction.

**Electrocardiographic Features**

Since partial and complete A-V block are associated with infarction of the posterior wall of the left ventricle, the electrocardiogram presents the Q, T, pattern typical of this. P-R interval prolongation alone is not associated with a specific electrocardiographic pattern. This prolongation is usually not greater than 0.24 sec., but may reach 0.40 sec.

Typical left bundle-branch block is twice as frequent as right bundle-branch block, even when the latter includes the atypical type characterized by a large, broad S-wave in lead I, regardless of axis deviation. The usual bundle-branch block pattern is often modified to some extent by the presence of infarction, and in turn, not infrequently masks the ordinary electrocardiographic signs of infarction. Bundle-branch block following occlusion is apt to present diminished voltage of the QRS complex, unusually prominent S-T deviations and variations in the direction of the T-waves. Furthermore, unlike chronic bundle-branch block, the configuration of the bundle-branch block often varies from day to day and sometimes changes from one type to the other, or to intraventricular block. These changes may be associated with a change in heart rate.

In approximately one-third of cases of bundle-branch block the characteristic progressive changes of infarction in the S-T interval and T-wave fail

to appear in the three standard leads, or are absent until the block remits. Not infrequently, however, typical alterations are present in the chest lead in such cases. An absent or very small initial positive deflection in this lead may be merely part of the bundle-branch block pattern, a fact confirmed in cases of transient bundle-branch block, but post-mortem observations in our cases indicated that it frequently represented infarction of the anterior wall.

#### Prognosis

Complete A-V and intraventricular block are of serious import in coronary artery occlusion. They occur more commonly in older persons with advanced cardiac disease, as evidenced by a history of hypertension, previous attacks of coronary occlusion and episodes of heart failure, and by the presence of considerable cardiac enlargement. The prognosis is poorest in complete block with a heart rate below 40 beats per minute; the combination of marked bradycardia and diminished cardiac output which follows infarction results in a fatal issue in over 75 per cent of cases. The mortality rate in our cases of intraventricular block, including bundle-branch block, was 42 per cent; it varied with the severity, but not the type, of conduction defect. Both complete A-V block and intraventricular block are usually associated with heart failure of severe degree. Partial block, unless there is a very slow rate, and simple prolongation of the P-R interval, do not affect the outcome of an attack adversely.

#### Treatment

Conduction defects in coronary artery occlusion, with the exception of complete heart block, do not require special therapy since they do not produce symptoms directly referable to them. Complete A-V block with Stokes-Adams' seizures, on the contrary, usually terminates fatally unless controlled. We have resorted to adrenalin, although in general we consider it dangerous in acute coronary artery occlusion. During a period of syncopal attacks 1 c.c. of a 1:1000 solution of adrenalin hydrochloride is injected intramuscularly as often as necessary until normal rhythm is restored or the ventricular rate becomes fixed. Then ephedrine sulphate in 30 mg. doses orally is given as often as is required to prevent the recurrence of seizures. Aminophyllin given by vein may be effective. This type of treatment is also necessary in rare cases of partial heart block with frequent dropped beats, resulting in a slow rate. Simple P-R prolongation may be abolished with atropin but this is unnecessary as it does not alter the course.

Since intraventricular block, including bundle-branch block, is usually associated with considerable heart failure, the general principles of the therapy of coronary occlusion should be stringently adhered to. These include complete rest, a low calorie diet, limitation of fluids and salt, and mercurial diuretics. We have found morphine, oxygen, and intravenous injections of aminophyllin often of aid in pulmonary edema or severe left ventricular failure. Digitalis,

quinidine and nitroglycerin should be avoided in the acute stage.

Arthur M. Master, M.D.  
Simon Dack, M.D. and  
Harry L. Jaffe, M.D.  
New York, N. Y.

#### Selected Summaries

Scott and Garvin: Amer. Heart Jour. V. 17, No. 4, April 1939, p. 436.

"Among 1082 cases of malignant disease appearing in a series of 11,100 consecutive postmortem examinations performed at the Cleveland City Hospital during the last twenty years, the heart, including the pericardium, was involved by metastatic tumor in 118 cases, an incident of 10.9 per cent. Carcinoma of the bronchus and the breast most often involved the heart and pericardium and accounted for 48 per cent of the cases in this series. The development of congestive failure without other apparent cause, in a patient with malignant disease, was the most important clinical finding pointing to cardiac metastasis."

A. Heinrich: Zeitschr. f. Kl. Med. Bd. 132, S. 583.

"A case has been described in which symptoms persisted during 14 years of medical observation which was regarded in different clinics as one of sepsis, dermatomyositis or periarteritis nodosa. At the last examination, because of a board-like hardness of the muscular indurations, a dermatomyositis was considered. The histologic examination of an excised piece of skin and muscle showed an exudative, necrotizing and proliferating angiitis, which, in all probability, should be classified in the group of allergic vascular diseases. Upon the basis of the clinical findings and course the clinical picture must be regarded as periarteritis nodosa."

#### Selected Abstract

Bartsch u. Wachner: Kl. Woch. Jg. 16, No. 21, May 22, 1937. Cardiac Injuries by Protracted-fractionated Radiation of the Upper Respiratory and Digestive Passages.

Since the vagus lies in a field, where radiation may lead to diminution of tonus and depression of excitability, the possibility of such an effect must be taken into consideration. Injury may be due to the direct action of the rays or to the development of protein bodies as the result of the radiation. The effects of exposure to the Roentgen rays may be a general diminution of tonus, a fall of blood pressure, increased frequency and even anoxemia and stenocardia. The same changes in general have been produced in animals which have been radiated only over the thigh, while the hearts were covered. Evidence of myocardial injury has appeared under such conditions. We believe that upon the basis of these findings, prophylaxis in the form of extensive bodily protection should be provided for in those patients to whom protracted-fractionated radiation of the upper respiratory and digestive passages is given.

